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Original Research

Intra- and inter-reliability of fleximetry in individuals with chronic shoulder pain

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ABSTRACT

Objective: To evaluate the intra- and inter-rater reliability of fleximetry in the measurement of range of motion (ROM) in individuals with chronic shoulder pain.
Design: Reliability study.
Setting: Physiotherapy clinic.
Participants: Thirty individuals of both genders, ages between 18 and 45 years, with chronic shoulder pain.
Main outcome measures: Fleximetry was used to measurement shoulder ROM (flexion, hyperextension, abduction, medial and lateral rotation, and horizontal abduction and adduction). Two examiners performed the evaluations of the shoulder ROM at two time points (interval of one week between them).
Results: In the intra-rater reliability, substantial to excellent reliability was found, with intraclass correlation coefficient (ICC) values ranging from 0.79 to 0.92, standard error of the measurement (SEM) values ranging from 5.70 to 8.72°, and minimum detectable change (MDC) values varying between 15.80 and 25.18°. Regarding the inter-rater reliability, moderate to excellent reliability was observed, with ICC values ranging from 0.68 to 0.96, SEM values ranging from 4.98 to 11.53°, and MDC values ranging from 13.82 to 31.97°.
Conclusion: The use of the fleximeter to measure shoulder ROM presents acceptable reliability values in individuals with chronic shoulder pain, which supports the use of this method of evaluation in research and clinical practice.

1. Introduction

Chronic and non-traumatic shoulder pain is one of the most frequent musculoskeletal complaints in athletes treated by sports rehabilitation services (Cobiella, 2004). In this context, the use of several measures to compose an evaluative routine of this population is common in rehabilitation centers, such as the assessment of pain intensity, functional aspects, catastrophizing, electromyographic activity, scapular dyskinesis, and range of motion (ROM) (Coronado et al., 2017; Huang, Huang, Ou, & Lin, 2016; Oliver, Plummer, & Gascon, 2016; Pekyavas & Baltaci, 2016).

Joint mobility within the normal ROM is a sign of joint integrity (Packer, Dibai-Filho, De Souza Costa, Dos Santos Berni, & Rodrigues-Bigaton, 2014). In athletes with shoulder pain, this measure has been commonly reported in clinical studies (Johansson, Svantesson, Tannerstedt, & Alricsson, 2016; Moreno-Pérez, Elvira, Fernandez-Fernandez, & Vera-Garcia, 2018; Moura, Monteiro, Lucareli, & Fukuda, 2016). However, an instrument frequently used for these purposes is the goniometer (Akyol et al., 2012; Guimarães et al., 2016; Pekyavas & Baltaci, 2016); and based on a study conducted by Hayes et al. (Hayes, Walton, Szomor, & Murrell, 2001), this

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instrument is a safe measure of shoulder ROM but presents a relative error inherent to its clinical use, with intraclass correlation coefficient (ICC) values varying from 0.53 to 0.69 and standard error of measurement (SEM) varying from 14° to 25°. In addition, the inclinometer is another instrument regularly used to measure the ROM, with acceptable reliability identified by previous studies (Sharma, Bærheim, & Kvåle, 2015; Walker et al., 2016; Werner et al., 2014); however, the disadvantage of the inclinometer is that it is the most expensive equipment of its kind.

Conversely, the fleximeter lacks scientific research addressing its reliability for the measurement of shoulder ROM. It is a low-cost instrument that is commonly used in research and clinical environments and consists of a pendular gravitational system that records the angle of joint movement (Florêncio et al., 2010). Some studies have used the fleximeter to assess the ROM of the cervical (Dibai-Filho, De Oliveira, Girasol, & Dias, 2017), hip (Ribeiro et al., 2015), knee (Coelho et al., 2014), and ankle regions (Oliveira et al., 2016).

Florêncio et al. (2010) conducted a study to investigate the reliability of the fleximeter to measure cervical ROM, showing ICC values ranging from 0.66 to 0.88. However, there is a lack of reliability studies in the scientific literature for the other joints of the body, including the shoulder joint. Therefore, the justification for conducting the present study was related to the possibility of supporting the use of the fleximeter in individuals with shoulder pain, conferring pioneering status to the study.

Accordingly, the objective of the present study was to evaluate the intra- and inter-rater reliability of fleximetry in the measurement of ROM in individuals with chronic shoulder pain. The hypothesis of the present study was that fleximetry is a reliable measure when considering different evaluation times and examiners for this population.

2. Methods

This was a reliability study conducted according to the Guidelines for Reporting Reliability and Agreement Studies (GRRAS). The researchers responsible for the measurement of shoulder flexibility were unaware of the clinical characteristics, functional disability, or pain of each evaluated participant.

The research was conducted at the Clinical School of Physiotherapy of Tiradentes University Center (Maceió, AL, Brazil), after the study procedures were approved by the Research Ethics Committee of the institution (protocol number 63860317.2.0000.5641). Participants were recruited in the communities around the university through verbal dissemination, posters, and the Internet. All participants included in the present study validated their participation by signing an informed consent form.

Calculation of the sample size was performed a priori based on the study conducted by Bonnett (Bonett, 2002). A coefficient of confidence of 0.95 and an amplitude of the confidence interval for the intra-class correlation coefficient (ICC) of 0.30 were considered. In addition, a calculation was performed to detect moderate reliability (ICC = 0.75) according to the study conducted by Fleiss (Fleiss, 1999, p. 432). Therefore, a sample size of 30 participants was estimated.

We included subjects of both genders aged between 18 and 45 years old, with impingement syndrome (SIS) in the dominant shoulder determined by means of a score ≥ 8 points in the pain or disability domain of the Shoulder Pain and Disability Index (SPADI), according to Breckenridge and McAuley (Breckenridge & McAuley, 2011). Moreover, to be considered with SIS, participants must have obtained a positive result in at least two of the following clinical orthopedic tests: Neer, Hawkins-Kennedy, and Jobe. Participants also presented with pain in the arch of movement for abduction or flexion of 60° to 120° (Tucci, Martins, Sposito, Camarini, & de Oliveira, 2014).

The following exclusion criteria were adopted: muscle injury; history of trauma or shoulder fractures; degenerative diseases related to the shoulder; ruptured tendons; ligament laxity; nerve or vascular lesions; use of anti-inflammatory drugs; surgical treatment; having undergone physical therapy in the last 6 months for the shoulder; and a medical diagnosis of rheumatic disease.

The evaluation procedures were as follows: a researcher with 8 years of experience in the measurement of pain performed the clinical evaluation and distributed the questionnaires at the beginning of the present study, while two other examiners who were previously trained and familiar for 6 months with the use of the fleximeter performed the evaluations of the shoulder ROM at two time points, with an interval of one week (Dibai-Filho et al., 2015); thus, allowing the measurement of intra- and inter-rater reliability.

With regards to the SPADI, this is a self-completion questionnaire that has been validated for the Brazilian population by Martins et al. (2010), and is frequently used to evaluate the functional disability and pain associated with shoulder dysfunction. The questionnaire is composed of 13 items distributed in two domains; pain (5 items) and function (8 items), scoring on a Likert scale between 0 (without difficulty) and 10 (failed to perform), as described by Roach et al. (Roach, Budiman-Mak, Songsiridej, & Lertratanakul, 1991). The values obtained by domain were summed and the mean of this score was calculated; subsequently, the final values were transformed into percentages ranging from 0 to 100%, with a higher score indicating a worse condition of the shoulder affected by dysfunction (Roach et al., 1991).

The Numerical Rating Pain Scale (NRPS) consists of a sequence of numbers from 0 to 10, in which the value 0 represents “no pain” and 10 represents the “worst pain you can imagine.” In this way, the volunteers graduated their pain based on these parameters (Ferreira-Valente, Pais-Ribeiro, & Jensen, 2011). Pain intensity was assessed with the participant at rest and following active shoulder movements.

The Pain-Related Catastrophizing Thoughts Scale (PCTS) was adapted and validated for the Brazilian population by Sardá Junior et al. (Sardá Junior et al., 2008), and is composed of 9 items staggered on a Likert scale, ranging from 0 to 5 points associated with the words “almost never” and “almost always” on the extremities. The total score is the sum of the items, divided by the number of items answered, where the minimum score can be 0 and the maximum can be 5. There are no cut-off points, with a higher score indicating the greater presence of catastrophizing thoughts.

Participants were evaluated by means of the Baecke questionnaire. The version of the questionnaire used in the present study contemplates the physical activities performed by the participant during their leisure time and daily activities. The usual physical activity score varies between 1 and 10 points, with no cutoff points; thus, minor scores in the questionnaire indicate less active participants (Florindo, Latorre, & do RDde, 2003).

Regarding the use of the fleximeter, the following shoulder ROMs were measured:

1) Flexion, participant in the supine position performed shoulder flexion with the fleximeter positioned on the lateral side of the arm;
2) Hyperextension, participant sitting performed shoulder hyperextension with the fleximeter positioned on the lateral side of the arm;
3) Abduction, participant in the lateral decubitus position performed abduction of the shoulder with the fleximeter positioned on the posterior face of the arm;